19-1332; Rev 2; 6/07



# Low-Voltage, Single-Supply Multiplexer and Switch

## General Description

The MAX4524/MAX4525 are low-voltage, single-supply CMOS analog switches configured as a 4-channel multiplexer/demultiplexer (MAX4524) and a double-pole/double-throw (DPDT) switch (MAX4525). Both have an inhibit input to simultaneously open all signal paths.

These devices operate from a single supply of +2V to +12V and are optimized for operation with +3V or +5V supplies. On-resistance is 200Ω with a +5V supply and 500Ω with a +3V supply. Each switch can handle Rail-to-Rail analog signals. The off-leakage current is only 2nA at +25°C or 20nA at +85°C.

All digital inputs have 0.8V to 2.4V logic thresholds, ensuring TTL/CMOS-logic compatibility when using a single +5V supply.

## Applications

Battery-Operated Equipment

Audio and Video Signal Routing

Low-Voltage Data-Acquisition Systems

Communications Circuits

## Features

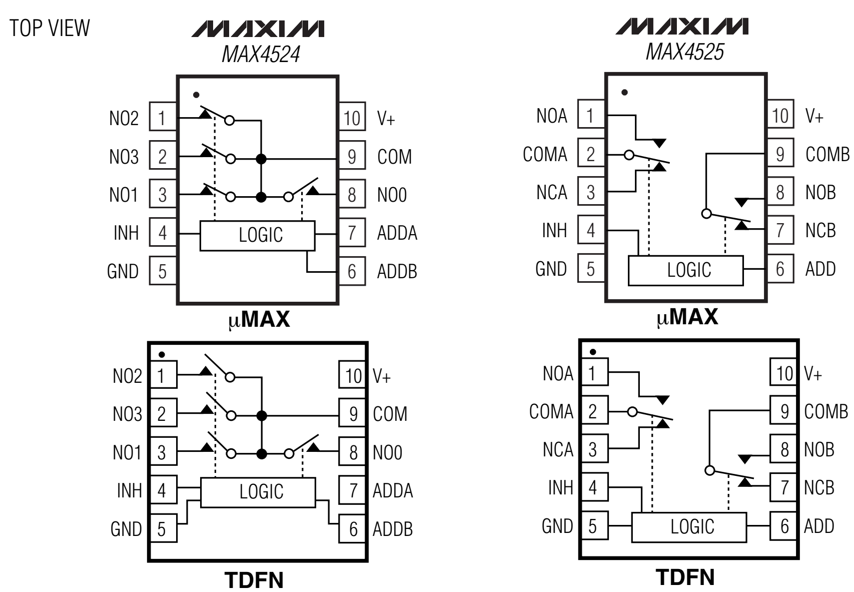
- ♦ **Tiny 10-Pin TDFN Package**
- ♦ **Single-Supply Operation from +2V to +12V**
- ♦ **200Ω On-Resistance with +5V Supply**
- ♦ **500Ω On-Resistance with +3V Supply**
- ♦ **Guaranteed 8Ω On-Resistance Match at +5V**
- ♦ **Guaranteed 2nA Max On-Leakage at +5V**
- ♦ **TTL/CMOS-Logic Compatible**

## Ordering Information

| PART | TEMP RANGE | PIN-PACKAGE | TOP MARK |
|---|---|---|---|
| **MAX4524**CUB | 0°C to +70°C | 10 µMAX | — |
| MAX4524C/D | 0°C to +70°C | Dice* | — |
| MAX4524EUB | -40°C to +85°C | 10 µMAX | — |
| MAX4524ETB | -40°C to +85°C | 10 TDFN-EP** (3mm x 3mm) | AAP |
| **MAX4525**CUB | 0°C to +70°C | 10 µMAX | — |
| MAX4525C/D | 0°C to +70°C | Dice* | — |
| MAX4525EUB | -40°C to +85°C | 10 µMAX | — |
| MAX4525ETB | -40°C to +85°C | 10 TDFN-EP** (3mm x 3mm) | AAQ |

*Contact factory for availability.
**EP = Exposed Pad.*

## Pin Configurations/Functional Diagrams/Truth Tables




**MAX4525**

| INH | ADD | ON SWITCH |
|---|---|---|
| 1 | X | NONE |
| 0 | 0 | COMA-NCA, COMB-NCB |
| 0 | 1 | COMA-NOA, COMB-NOB |

**MAX4524**

| INH | ADDB | ADDA | ON SWITCH |
|---|---|---|---|
| 1 | X | X | NONE |
| 0 | 0 | 0 | COM-NO0 |
| 0 | 0 | 1 | COM-NO1 |
| 0 | 1 | 0 | COM-NO2 |
| 0 | 1 | 1 | COM-NO3 |

X = DON'T CARE

# Low-Voltage, Single-Supply Multiplexer and Switch

## ABSOLUTE MAXIMUM RATINGS

(Voltages Referenced to GND)
V+ ..............................................................................-0.3V, +13V
Voltage into any terminal (Note 1) ................-0.3V to (V+ + 0.3V)
Continuous Current into any Terminal ..............................±20mA
Peak Current, NO, NC or COM_
(pulsed at 1ms,10% duty cycle)....................................±40mA
ESD per Method 3015.7 ..................................................>2000V

Continuous Power Dissipation ($T_A$ = +70°C)
10-Pin μMAX (derate 4.1mW/°C above +70°C) ............330mW
10-Pin TDFN (derate 24.4mW/°C above +70°C) ........1951mW
Operating Temperature Ranges
MAX452_C_ _ ......................................................0°C to +70°C
MAX452_E_ _....................................................-40°C to +85°C
Storage Temperature Range .............................-65°C to +150°C

**Note 1:** Voltages exceeding V+ or GND on any signal terminal are clamped by internal diodes. Limit forward-diode current to maximum current rating.

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

## ELECTRICAL CHARACTERISTICS—Single +5V Supply

(V+ = 4.5V to 5.5V, GND = 0V, $V_{AH}$ = 2.4V, $V_{AL}$ = 0.8V, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.) (Notes 2, 7)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP (Note 2) | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{COM}$, $V_{NO}$ | | | C, E | V- | | V+ | V |
| COM-NO/NC On-Resistance | $R_{ON}$ | V+ = 4.5V, $I_{COM}$ = 1mA, $V_{COM}$ = 3.5V | | +25°C | | 90 | 150 | Ω |
| | | | | C, E | | | 200 | |
| COM-NO/NC On-Resistance Match Between Channels (Note 3) | $\Delta R_{ON}$ | V+ = 4.5V, $I_{COM}$ = 1mA, $V_{COM}$ = 3.5V | | +25°C | | 2 | 10 | Ω |
| | | | | C, E | | | 15 | |
| COM-NO/NC On-Resistance Flatness (Note 4) | $R_{FLAT}$ | V+ = 5.5V; $I_{COM}$ = 1mA; $V_{COM}$ = 1.5V, 2.5V, 3.5V | | +25°C | | 5 | 12 | Ω |
| NO/NC Off-Leakage (Note 5) | $I_{NO(OFF)}$, $I_{NC(OFF)}$, | V+ = 5.5V; $V_{NO}$ = 1V, 4.5V; $V_{COM}$ = 4.5V, 1V | | +25°C | -1 | | +1 | nA |
| | | | | C, E | -10 | | +10 | |
| COM Off-Leakage (Note 5) | $I_{COM(OFF)}$ | V+ = 5.5V; $V_{NO}$ = 1V, 4.5V; $V_{COM}$ = 4.5V, 1V | MAX4524 | +25°C | -2 | | +2 | nA |
| | | | | C, E | -50 | | +50 | |
| | | | MAX4525 | +25°C | -1 | | +1 | |
| | | | | C, E | -25 | | +25 | |
| COM On-Leakage (Note 5) | $I_{COM(ON)}$ | V+ = 5.5V; $V_{COM}$ = 4.5V, 1V | MAX4524 | +25°C | -2 | | +2 | nA |
| | | | | C, E | -50 | | +50 | |
| | | | MAX4525 | +25°C | -1 | | +1 | |
| | | | | C, E | -25 | | +25 | |
| **DIGITAL I/O** | | | | | | | | |
| Logic Input Logic Threshold High | $V_{IH}$ | | | C, E | | 1.5 | 2.4 | V |
| Logic Input Logic Threshold Low | $V_{IL}$ | | | C, E | 0.8 | 1.5 | | V |
| Input Current High | $I_{IH}$ | $V_A$ = $V_{INH}$ = 2.4V | | C, E | -1 | | +1 | μA |
| Input Current Low | $I_{IH}$ | $V_A$ = $V_{INH}$ = 0.8V | | C, E | -1 | | +1 | μA |

## ELECTRICAL CHARACTERISTICS—Single +5V Supply (continued)

($V+$ = 4.5V to 5.5V, GND = 0V, $V_{AH}$ = 2.4V, $V_{AL}$ = 0.8V, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.) (Notes 2, 7)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP (Note 2) | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **SWITCH DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Inhibit Turn-On Time | $t_{(ON)}$ | $V_{NO_}$ = 3V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 2 | | +25°C | | 90 | 150 | ns |
| | | | | C, E | | | 200 | |
| Inhibit Turn-Off Time | $t_{(OFF)}$ | $V_{NO_}$ = 3V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 2 | | +25°C | | 40 | 120 | ns |
| | | | | C, E | | | 180 | |
| Address Transition Time | $t_{TRANS}$ | $V_{NO_}$ = 3V/0V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 1 | | +25°C | | 90 | 150 | ns |
| | | | | C, E | | | 200 | |
| Break-Before-Make Time | $t_{BBM}$ | $V_{NO_}$ = 3V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 3 | | +25°C | 5 | 20 | | ns |
| Charge Injection (Note 6) | Q | C = 1nF, $R_S$ = 0Ω, $V_S$ = 2.5V, Figure 4 | | +25°C | | 0.8 | 5 | pC |
| NO/NC Off-Capacitance | $C_{NO(OFF)}$ | $V_{NO_}$ = 0V, f = 1MHz, Figure 6 | | +25°C | | 4 | | pF |
| COM Off-Capacitance | $C_{COM(OFF)}$ | $V_{NO_}$ = 0V, f = 1MHz, Figure 6 | MAX4524 | +25°C | | 14 | | pF |
| | | | MAX4525 | +25°C | | 6 | | |
| COM On-Capacitance | $C_{COM(ON)}$ | $V_{NO_}$ = 0V, f = 1MHz, Figure 6 | MAX4524 | +25°C | | 20 | | pF |
| | | | MAX4525 | +25°C | | 12 | | |
| Off-Isolation | $V_{ISO}$ | $R_L$ = 50Ω, f = 1MHz, Figure 5 | | +25°C | | -75 | | dB |
| Channel-to-Channel Crosstalk (MAX4525) | $V_{CT}$ | $R_L$ = 50Ω, f = 1MHz, Figure 5 | | +25°C | | -74 | | dB |
| Total Harmonic Distortion | THD | $R_L$ = 600Ω, $V_{COM}$ = 2.5Vp-p, 20Hz to 20kHz | | +25°C | | 0.2 | | % |
| **POWER SUPPLY** | | | | | | | | |
| Power-Supply Range | V+ | | | C, E | 2 | | 12 | V |
| Power-Supply Current | I+ | V+ = 5.5V, $V_{ADD}$ = $V_{INH}$ = V+ or 0V | | +25°C | -1 | | +1 | µA |
| | | | | C, E | -10 | | +10 | |

## ELECTRICAL CHARACTERISTICS—Single +3V Supply

($V+$ = 2.7V to 3.6V, GND = 0V, $V_{AH}$ = 2.0V, $V_{AL}$ = 0.5V, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.) (Notes 2, 7)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP (Note 2) | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{COM}$, $V_{NO}$ | | | C, E | V- | | V+ | V |
| COM-NO/NC On-Resistance | $R_{ON}$ | V+ = 2.7V, $I_{COM}$ = 0.1mA, $V_{COM}$ = 1.5V | | +25°C | | 190 | 400 | Ω |
| | | | | C, E | | | 500 | |
| NO/NC Off-Leakage (Note 6) | $I_{NO(OFF)}$, $I_{NC(OFF)}$ | V+ = 3.6V; $V_{NO}$ = 1V, 3V; $V_{COM}$ = 3V, 1V | | +25°C | -1 | | +1 | nA |
| | | | | C, E | -10 | | +10 | |
| COM Off-Leakage (Note 6) | $I_{COM(OFF)}$ | V+ = 3.6V; $V_{NO}$ = 1V, 3V; $V_{COM}$ = 3V, 1V | MAX4524 | +25°C | -2 | | +2 | nA |
| | | | | C, E | -50 | | +50 | |
| | | | MAX4525 | +25°C | -1 | | +1 | |
| | | | | C, E | -25 | | +25 | |

## ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

($V+ = 2.7V$ to $3.6V$, $GND = 0V$, $V_{AH} = 2.0V$, $V_{AL} = 0.5V$, $T_A = T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A = +25°C$.) (Notes 2, 7)

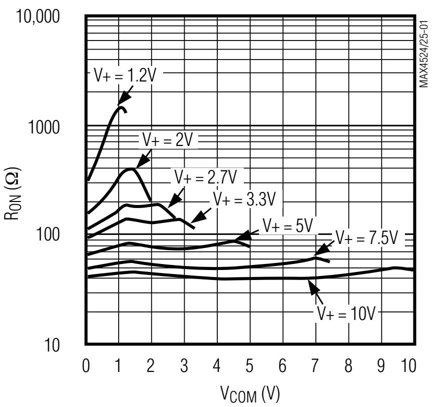
| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP (Note 2) | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| COM On-Leakage (Note 6) | $I_{COM(ON)}$ | V+ = 3.6V; $V_{COM}$ = 3V, 1V | MAX4524 | +25°C | -2 | | +2 | nA |
| | | | | C, E | -50 | | +50 | |
| | | | MAX4525 | +25°C | -1 | | +1 | |
| | | | | C, E | -25 | | +25 | |
| **DIGITAL I/O** | | | | | | | | |
| Logic Input Logic Threshold High | $V_{IH}$ | | | C, E | | 1.0 | 2.0 | V |
| Logic Input Logic Threshold Low | $V_{IL}$ | | | C, E | 0.5 | 1.0 | | V |
| Input Current High | $I_{IH}$ | $V_A = V_{INH} = 2.0V$ | | C, E | -1 | | +1 | µA |
| Input Current Low | $I_{IH}$ | $V_A = V_{INH} = 0.5V$ | | C, E | -1 | | +1 | µA |
| **SWITCH DYNAMIC CHARACTERISTICS** (Note 6) | | | | | | | | |
| Inhibit Turn-On Time | $t_{(ON)}$ | $V_{NO_}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 2 | | +25°C | | 170 | 300 | ns |
| | | | | C, E | | | 400 | |
| Inhibit Turn-Off Time | $t_{(OFF)}$ | $V_{NO_}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 2 | | +25°C | | 50 | 200 | ns |
| | | | | C, E | | | 300 | |
| Address Transition Time | $t_{TRANS}$ | $V_{NO_}$ = 1.5V/0V, $R_L$ = 300Ω, $C_L$ = 35pF, Figure 1 | | +25°C | | 130 | 300 | ns |
| | | | | C, E | | | 400 | |
| Break-Before-Make Time | $t_{BBM}$ | Figure 3, $V_{NO_}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF | | +25°C | 5 | 40 | | ns |
| **POWER SUPPLY** | | | | | | | | |
| Power-Supply Current | I+ | V+ = 3.6V, $V_{ADD} = V_{INH}$ = V+ or 0V | | +25°C | -1 | | +1 | µA |
| | | | | C, E | -10 | | +10 | |

**Note 2:** The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.
**Note 3:** $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$
**Note 4:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges; i.e., $V_{NO}$ = 3V to 0V and 0V to 3V.
**Note 5:** Leakage parameters are 100% tested at maximum-rated hot operating temperature, and guaranteed by correlation at $T_A = +25°C$.
**Note 6:** Guaranteed by design, not production tested.
**Note 7:** TDFN parts are tested at +25°C and are guaranteed by design and correlation over the entire temperature range.

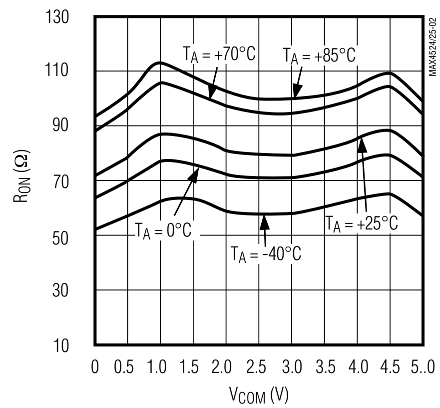
## Typical Operating Characteristics

(V+ = 5V, GND = 0V, $T_A$ = +25°C, unless otherwise noted.)

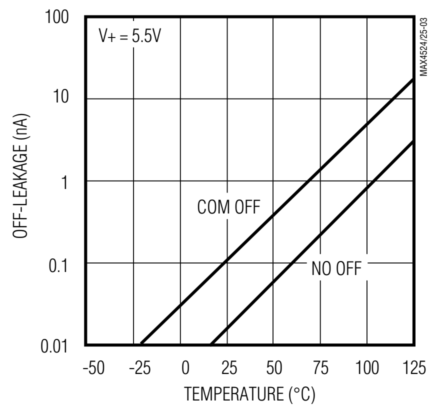
**ON-RESISTANCE vs. $V_{COM}$**



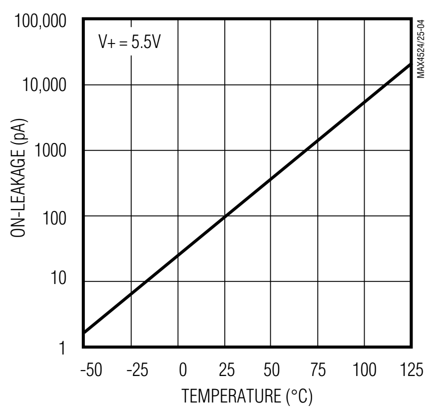

**ON-RESISTANCE vs. $V_{COM}$ AND TEMPERATURE**



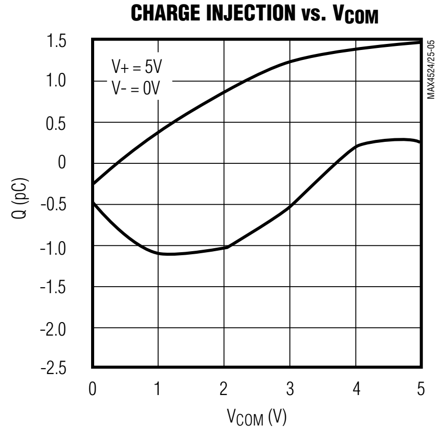

**OFF-LEAKAGE vs. TEMPERATURE**



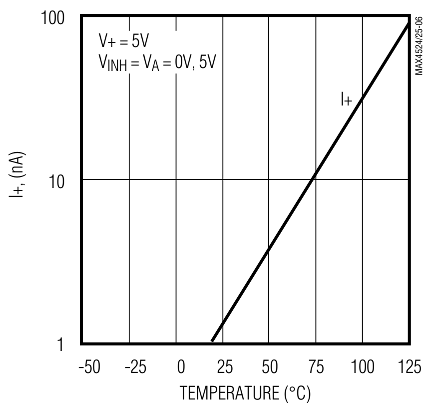

**ON-LEAKAGE vs. TEMPERATURE**



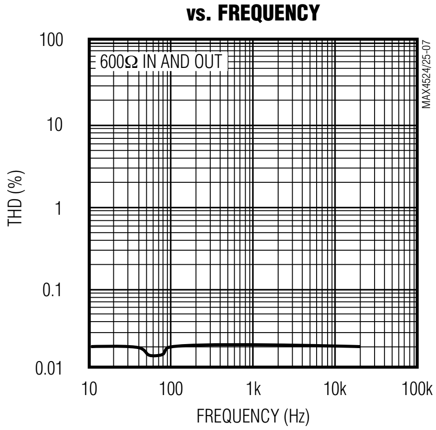

**CHARGE INJECTION vs. $V_{COM}$**



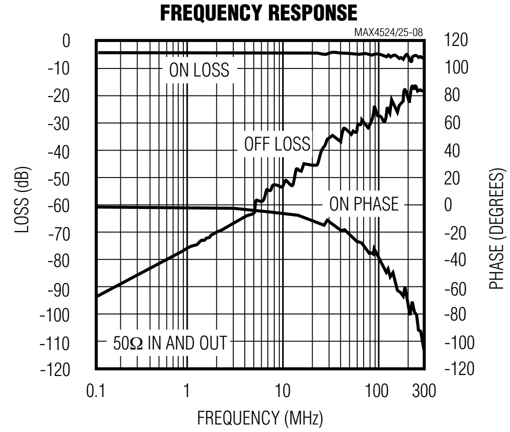

**SUPPLY CURRENT vs. TEMPERATURE**




**TOTAL HARMONIC DISTORTION vs. FREQUENCY**



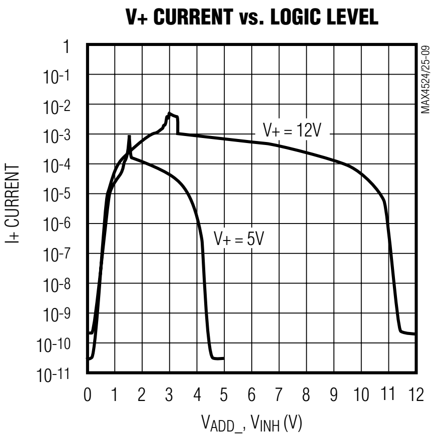

**FREQUENCY RESPONSE**

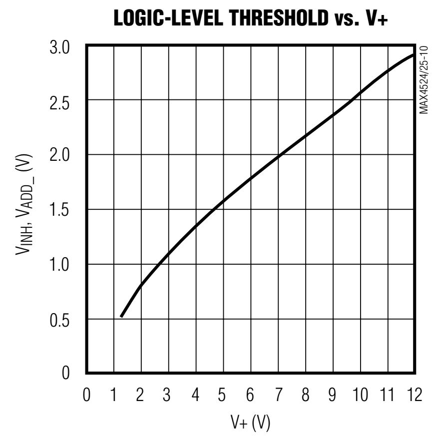


# Low-Voltage, Single-Supply Multiplexer and Switch

## Typical Operating Characteristics (continued)

(V+ = +5V, GND = 0V, $T_A$ = +25°C, unless otherwise noted.)




## Pin Description

| MAX4524 | MAX4525 | NAME | FUNCTION |
|---|---|---|---|
| 1 | — | NO2 | Analog Switch Normally Open Input 2 |
| — | 1 | NOA | Analog Switch “A” Normally Open Input |
| 2 | — | NO3 | Analog Switch Normally Open Input 3 |
| — | 2 | COMA | Analog Switch “A” Common |
| 3 | — | NO1 | Analog Switch Normally Open Input 1 |
| — | 3 | NCA | Analog Switch “A” Normally Closed Input |
| 4 | 4 | INH | Inhibit. Connect to GND for normal operation. Connect to logic-level high to turn all switches off. |
| 5 | 5 | GND | Ground. Connect to digital ground (analog signals have no ground reference, but are limited to V+ and GND). |
| 6 | — | ADDB | Logic-Level Address Input (see *Truth Tables*) |
| — | 6 | ADD | Logic-Level Address Input (see *Truth Tables*) |
| 7 | — | ADDA | Logic-Level Address Input (see *Truth Tables*) |
| — | 7 | NCB | Analog Switch “B” Normally Closed Input |
| 8 | — | NO0 | Analog Switch Normally Open Input 0 |
| — | 8 | NOB | Analog Switch “B” Normally Open Input |
| 9 | — | COM | Analog Switch Common |
| — | 9 | COMB | Analog Switch “A” Common |
| 10 | 10 | V+ | Positive Analog and Digital Supply-Voltage Input |
| EP | EP | EP | TDFN Package Only. Exposed pad, connect to V+. |

**Note:** NO_, NC_, and COM_ analog signal pins are identical and interchangeable. Any may be considered an input or output; signals pass equally well in both directions.

## Applications Information

### Power-Supply Considerations

The MAX4524/MAX4525's construction is typical of most CMOS analog switches. They have two supply pins: V+ and GND. V+ and GND are used to drive the internal CMOS switches and set the limits of the analog voltage on any switch. Reverse ESD-protection diodes are internally connected between each analog signal pin and both V+ and GND. If any analog signal exceeds V+ or GND, one of these diodes will conduct. During normal operation, these (and other) reverse-biased ESD diodes leak, forming the only current drawn from V+ or GND.

Virtually all the analog leakage current comes from the ESD diodes. Although the ESD diodes on a given signal pin are identical, and therefore fairly well balanced, they are reverse-biased differently. Each is biased by either V+ or GND and the analog signal. This means that leakage will vary as the signal varies. The difference in the two diode leakages to the V+ and GND pins constitutes the analog signal-path leakage current. All analog leakage current flows between each pin and one of the supply terminals, not to the other switch terminal. This is why both sides of a given switch can show leakage currents of either the same or opposite polarity.

## Test Circuits/Timing Diagrams

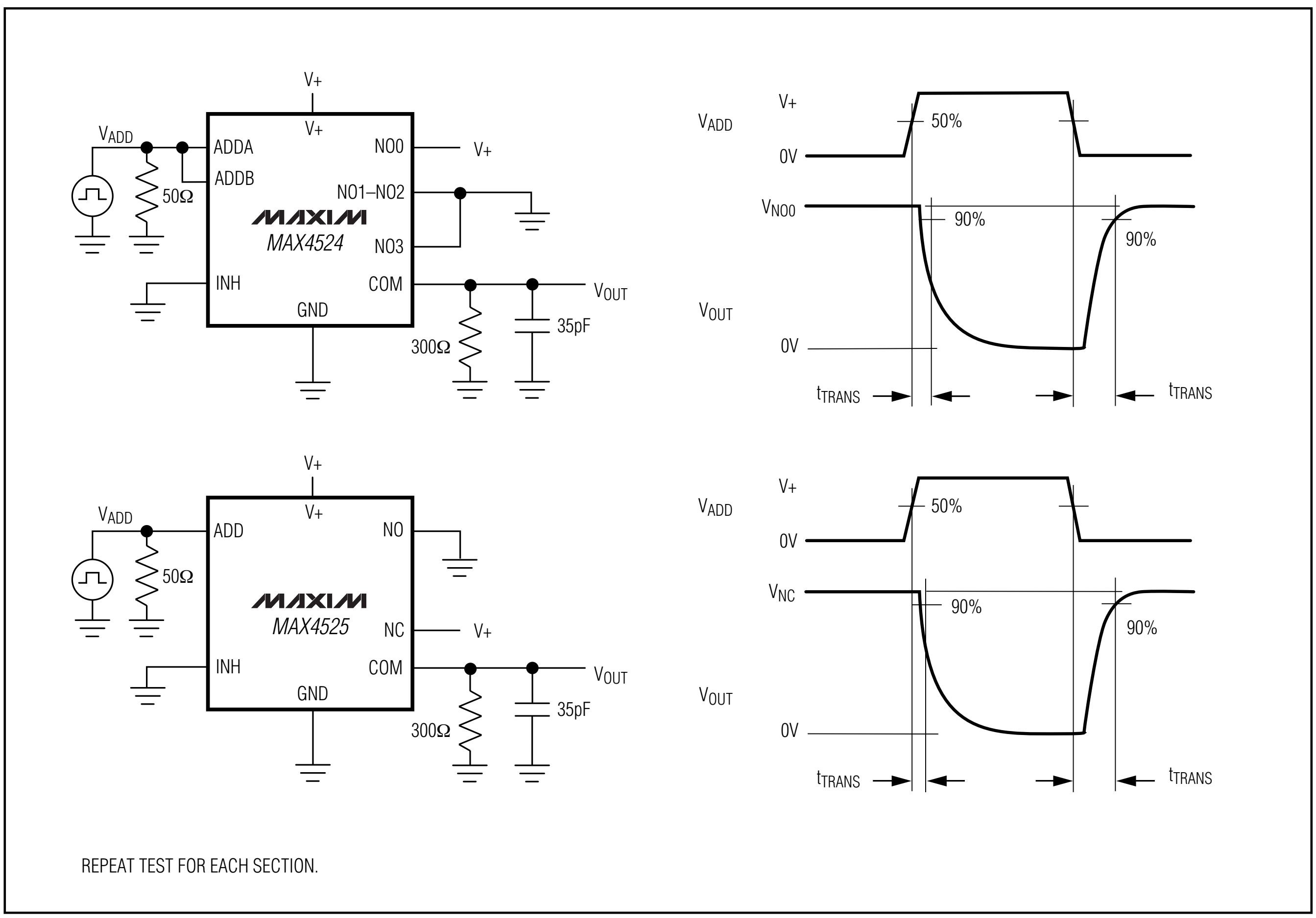



*Figure 1. Address Transition Time*

There is no connection between the analog signal paths and GND. V+ and GND power the internal logic and logic-level translators, and set both the input and output logic limits. The logic-level translators convert the logic levels into switched V+ and GND signals to drive the gates of the analog signals. This drive signal is the only connection between the logic supplies (and signals) and the analog supplies. V+ has an ESD-protection diode to GND.

### Low-Voltage Operation

These devices operate from a single supply between +2V and +12V. At room temperature, they actually "work" with a single supply at near or below +1.7V, although as supply voltage decreases, switch on-resistance and switching times become very high.

### High-Frequency Performance

In 50Ω systems, signal response is reasonably flat up to 50MHz (see *Typical Operating Characteristics*). Above 20MHz, the on-response has several minor peaks, which are highly layout dependent. The problem is not turning the switch on, but turning it off. The off-state switch acts like a capacitor, and passes higher frequencies with less attenuation. At 10MHz, off-isolation is about -50dB in 50Ω systems, becoming worse (approximately 20dB per decade) as frequency increases. Higher circuit impedances also degrade off-isolation. Adjacent channel attenuation is about 3dB above that of a bare IC socket, and is entirely due to capacitive coupling.

## Test Circuits/Timing Diagrams (continued)

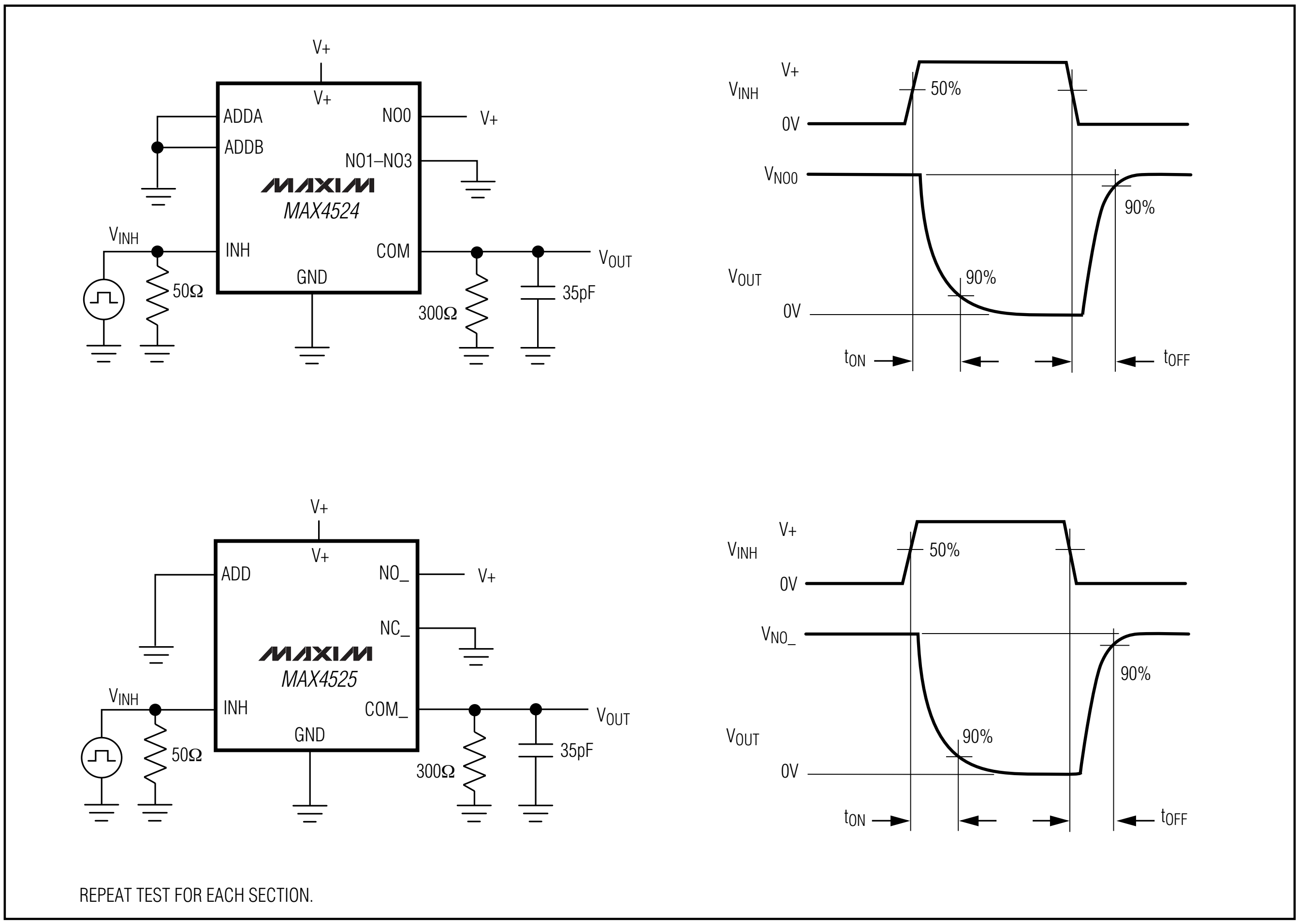



*Figure 2. Inhibit Switching Times*

## Test Circuits/Timing Diagrams (continued)

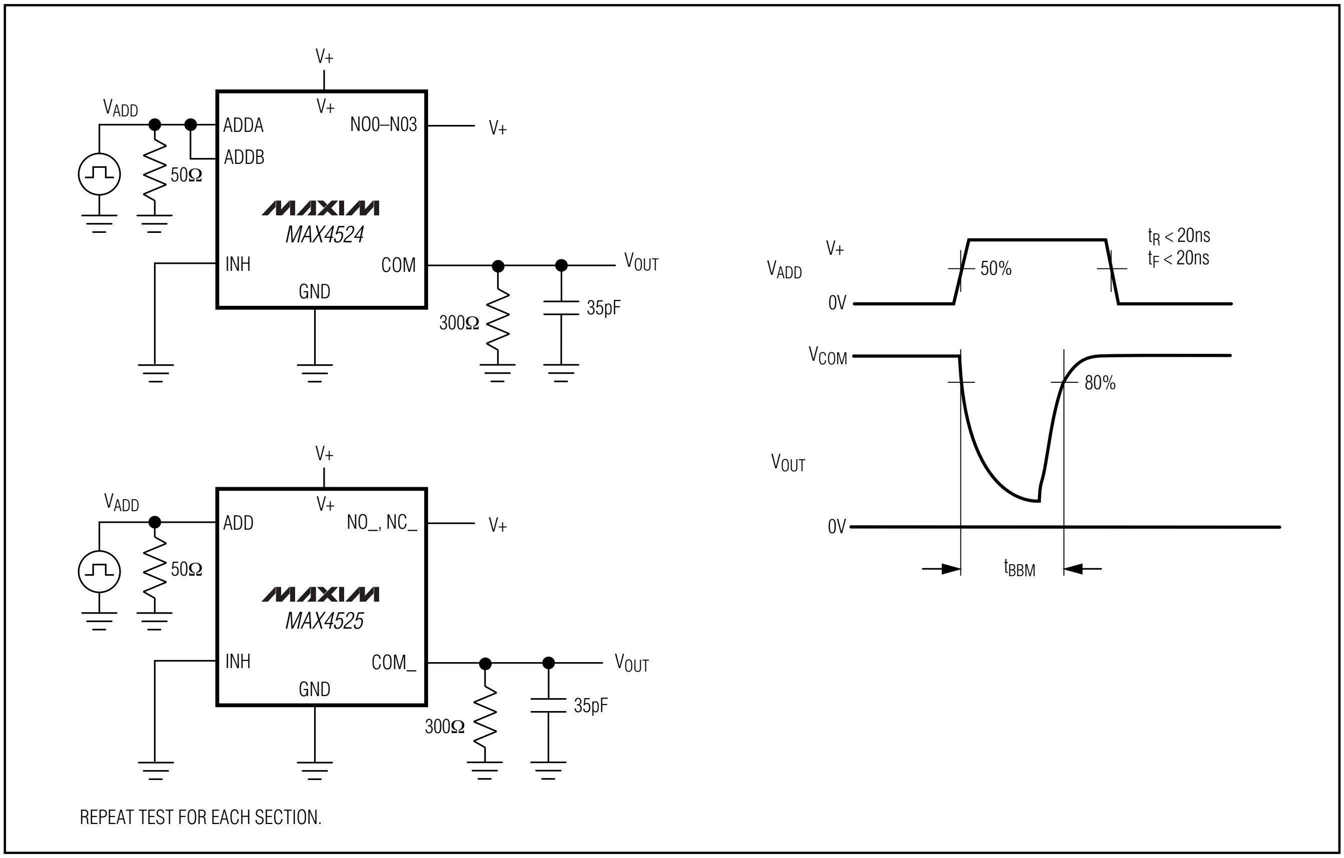



*Figure 3. Break-Before-Make Interval*

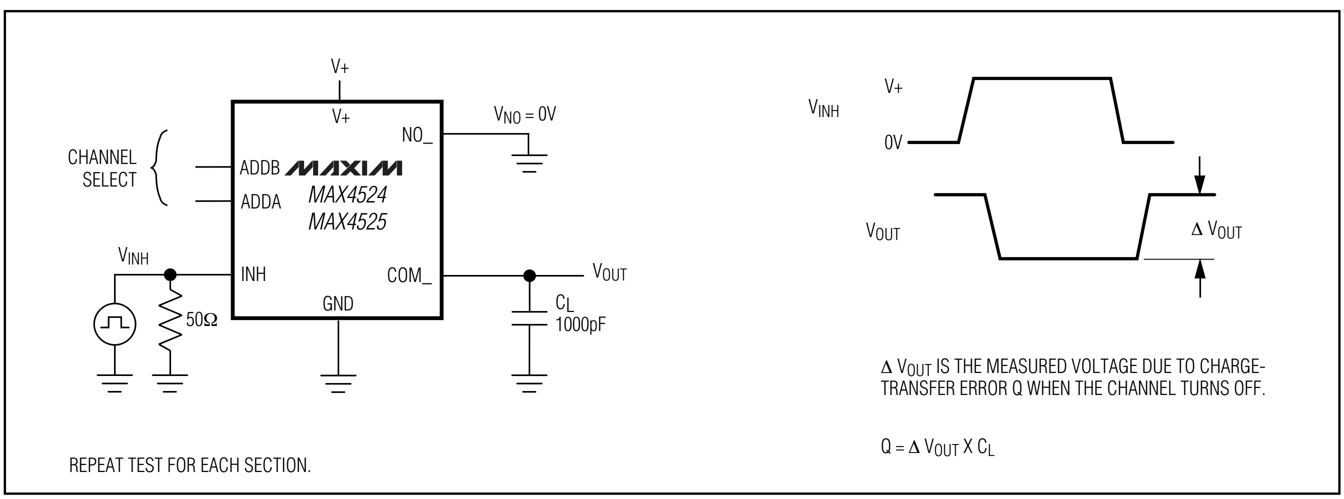
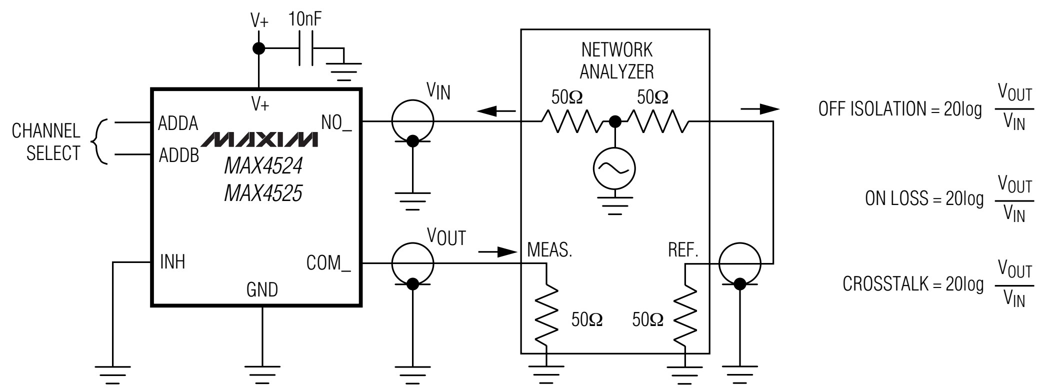



*Figure 4. Charge Injection*

# Low-Voltage, Single-Supply Multiplexer and Switch

## Test Circuits/Timing Diagrams (continued)




MEASUREMENTS ARE STANDARDIZED AGAINST SHORT AT SOCKET TERMINALS.
OFF-ISOLATION IS MEASURED BETWEEN COM AND "OFF" NO TERMINAL ON EACH SWITCH.
ON-LOSS IS MEASURED BETWEEN COM AND "ON" NO TERMINAL ON EACH SWITCH.
CROSSTALK (MAX4524) IS MEASURED FROM ONE CHANNEL (A, B) TO OTHER CHANNEL.
SIGNAL DIRECTION THROUGH SWITCH IS REVERSED; WORST VALUES ARE RECORDED.

*Figure 5. Off-Isolation, On-Loss, and Crosstalk*

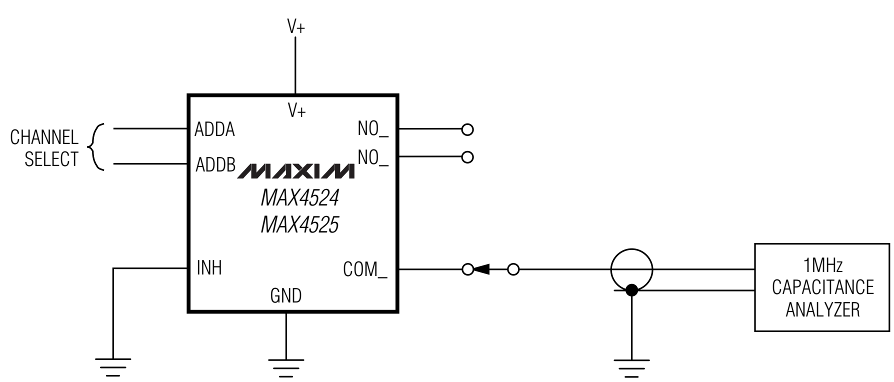
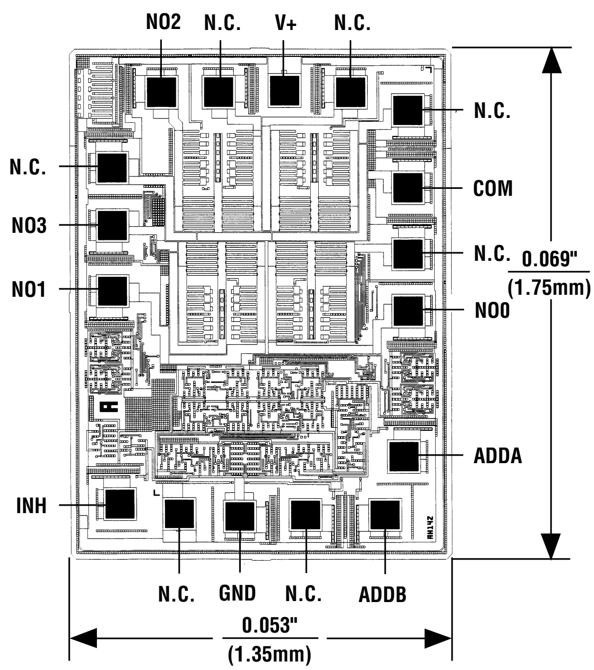


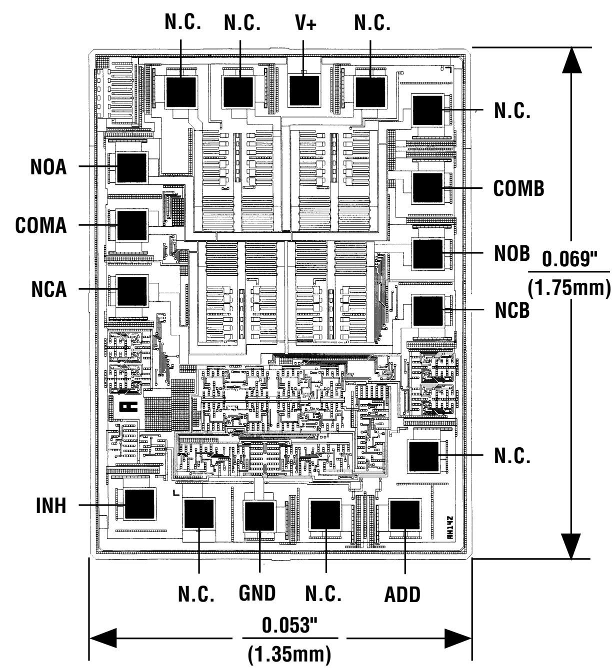

*Figure 6. NO/COM Capacitance*

## Chip Topographies

MAX4524




MAX4525




N.C. = No Connection

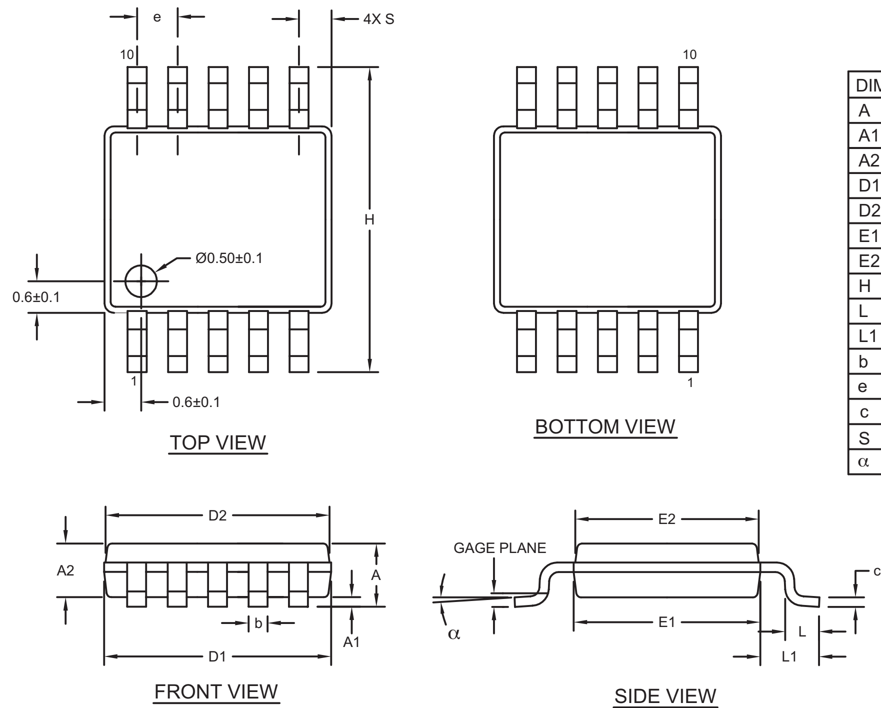
TRANSISTOR COUNT: 219

SUBSTRATE CONNECTED TO V+

# Low-Voltage, Single-Supply Multiplexer and Switch

## Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)




| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | - | 0.043 | - | 1.10 |
| A1 | 0.002 | 0.006 | 0.05 | 0.15 |
| A2 | 0.030 | 0.037 | 0.75 | 0.95 |
| D1 | 0.116 | 0.120 | 2.95 | 3.05 |
| D2 | 0.114 | 0.118 | 2.89 | 3.00 |
| E1 | 0.116 | 0.120 | 2.95 | 3.05 |
| E2 | 0.114 | 0.118 | 2.89 | 3.00 |
| H | 0.187 | 0.199 | 4.75 | 5.05 |
| L | 0.0157 | 0.0275 | 0.40 | 0.70 |
| L1 | 0.037 REF | | 0.940 REF | |
| b | 0.007 | 0.0106 | 0.177 | 0.270 |
| e | 0.0197 BSC | | 0.500 BSC | |
| c | 0.0035 | 0.0078 | 0.090 | 0.200 |
| S | 0.0196 REF | | 0.498 REF | |
| α | 0° | 6° | 0° | 6° |

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO-187C-BA.

DALLAS SEMICONDUCTOR MAXIM

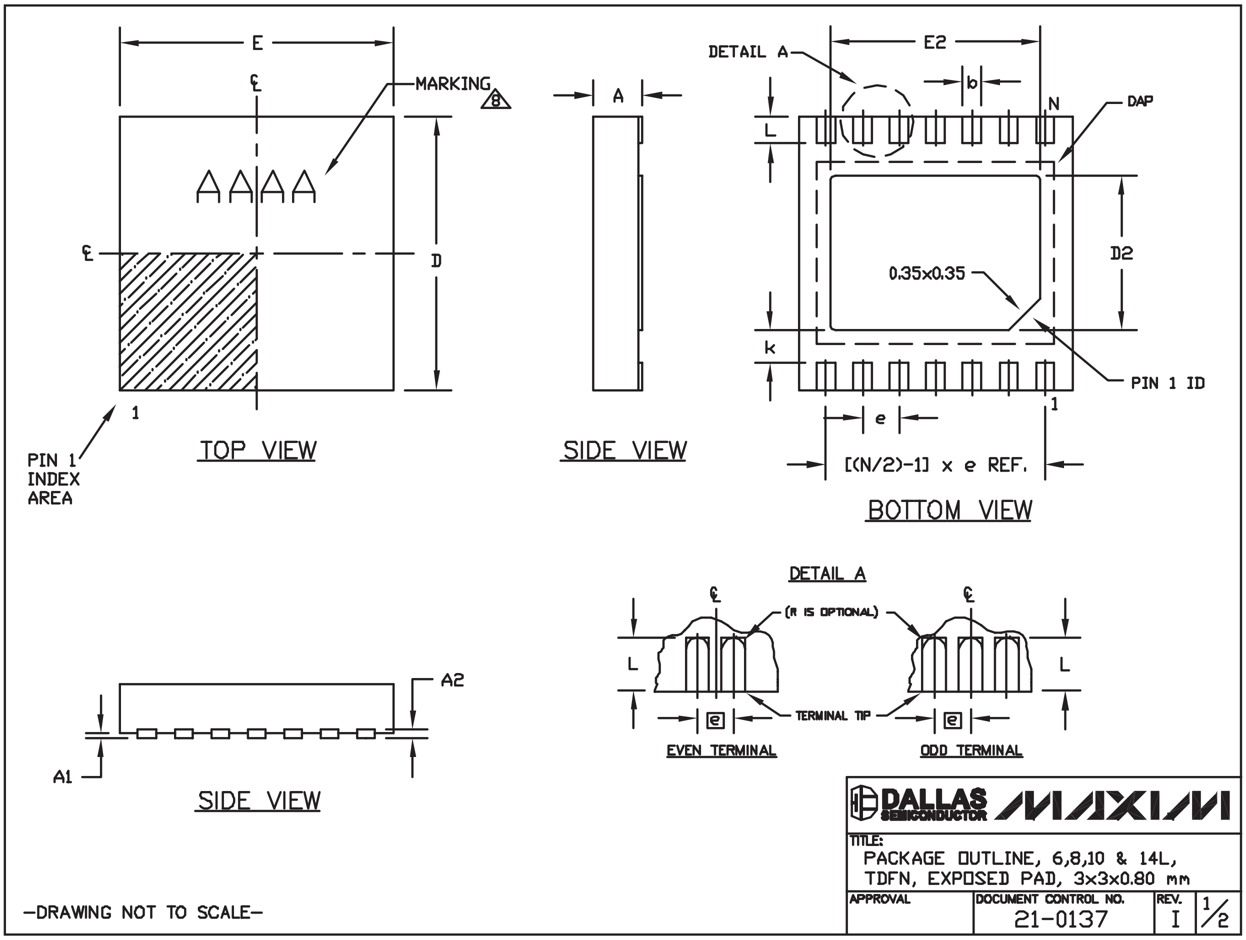
PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 10L uMAX/uSOP

| APPROVAL | DOCUMENT CONTROL NO. | REV. | |
|---|---|---|---|
| | 21-0061 | I | 1/1 |

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)




6, 8, &10L, DFN THIN.EPS

# Low-Voltage, Single-Supply Multiplexer and Switch

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)

| COMMON DIMENSIONS | | |
|---|---|---|
| SYMBOL | MIN. | MAX. |
| A | 0.70 | 0.80 |
| D | 2.90 | 3.10 |
| E | 2.90 | 3.10 |
| A1 | 0.00 | 0.05 |
| L | 0.20 | 0.40 |
| k | 0.25 MIN. | |
| A2 | 0.20 REF. | |

| PACKAGE VARIATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| PKG. CODE | N | D2 | E2 | e | JEDEC SPEC | b | [(N/2)-1] x e |
| T633-2 | 6 | 1.50±0.10 | 2.30±0.10 | 0.95 BSC | MO229 / WEEA | 0.40±0.05 | 1.90 REF |
| T833-2 | 8 | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC | 0.30±0.05 | 1.95 REF |
| T833-3 | 8 | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC | 0.30±0.05 | 1.95 REF |
| T1033-1 | 10 | 1.50±0.10 | 2.30±0.10 | 0.50 BSC | MO229 / WEED-3 | 0.25±0.05 | 2.00 REF |
| T1033-2 | 10 | 1.50±0.10 | 2.30±0.10 | 0.50 BSC | MO229 / WEED-3 | 0.25±0.05 | 2.00 REF |
| T1433-1 | 14 | 1.70±0.10 | 2.30±0.10 | 0.40 BSC | - - - - | 0.20±0.05 | 2.40 REF |
| T1433-2 | 14 | 1.70±0.10 | 2.30±0.10 | 0.40 BSC | - - - - | 0.20±0.05 | 2.40 REF |

NOTES:
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
5. DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.
6. "N" IS THE TOTAL NUMBER OF LEADS.
7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
8. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 6,8,10 & 14L, TDFN, EXPOSED PAD, 3x3x0.80 mm

APPROVAL | DOCUMENT CONTROL NO. 21-0137 | REV. I | 2/2

-DRAWING NOT TO SCALE-

## Revision History

Pages changed at Rev 2: 1, 2, 4, 6, 13,14